Understanding and Strategies for Controlled Interfacial Phenomena in Li-ion Batteries and Beyond

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

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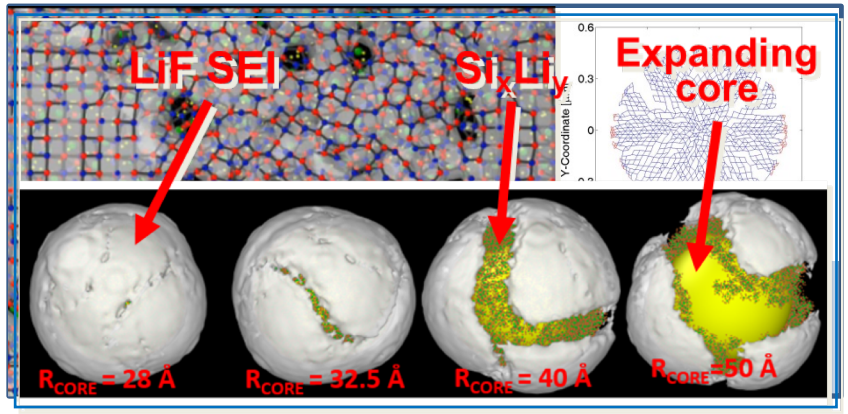
- ***Objective:*** Evaluate and characterize interfacial phenomena in lithiated Si and Li metal anodes; develop guidelines for potential solutions leading to controlled reactivity at electrode/electrolyte interfaces.

Impact:

- Through a better understanding, define electrolyte and electrode properties required in high performance cells
- Develop strategies to control Si anode instability and pulverization issues, and short lifetimes and safety issues of Li metal anodes.

Cracking modes of a Si nanoparticle



Accomplishments:

- Characterization of reactions and SEI formation at the Li metal anode under applied potential
- Characterization of cracking of lithiated Si nanoparticles; effects on SEI layer; effects of possible mitigation strategies (graphene and polymer coatings)
- Evolution of Si nanoparticle during battery charge: lithiation and swelling; dendrite formation under overcharge.
- Identification of coupling of chemical and mechanical effects on cracking and surface damage.
- Development of a heterogeneous SEI growth model.

FY 18 Milestones:

- Characterization of Li deposition modes
- Effects of operating conditions on dendrite growth
- Evaluation of mitigation strategies for dendrite growth

FY18 Deliverables: Li deposition trends; effects of electrolyte composition; C-rate; presence of other ions

Funding:

— FY18: $446,408 , FY17: $442,656